ARITHMETIC.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

64. Proposed by J. K. ELLWOOD, A. M., Principal of Colfax School, Pittsburg, Pennsylvania.

If 27 men in 10 days of 7 hours each for \$375 dig a ditch 70 rods long, 25 feet wide, and 4 feet deep, how long a ditch 40 feet wide and 3 feet deep will 15 men dig in 16 days of 9 hours each for \$500?

III. Solution by the PROPOSER.

Mr. Gruber's method is all right except the *assumption* that the length of the ditch increases as the price paid. The \$375 pays for 1890 hours' labor; at the same rate, \$500 would pay for 2520 hours' work. But there are only 2160 hours worked. Hence, the *efficiency* must be increased $\frac{1}{6}$. That is, the ditch will be $66\frac{2}{3}$ rods $\times \frac{7}{6} = 77\frac{7}{9}$ rods long.

Or, in another light: Since 1890 hours' labor are worth \$375, 2160 hours' work, at same wages, are worth $\$428\frac{4}{7}$. But they get \$500, an increase of $\frac{1}{6}$ as before.

In this problem the *time* is limited—fixed—hence the only thing that can vary is the *efficiency* of the workmen. And it seems plain that it must increase as the *hourly* price increases—not as the *gross* price. Suppose

2 men in 1 day of 10 hours for \$20 dig x rods, and

3 men in 2 days of 10 hours for \$40 dig y rods. What is the ratio of y to x?

Can the *efficiency*, or productiveness, be found without considering the *hourly* wages?

66. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.

Brown adds $m=10\%$ of water to the pure wine he buys, and then sells the mixture at a price $n=10\%$ greater than the cost price of the pure wine. What is his rate per cent. of profit?

Solution by E. W. MORRELL, Professor of Mathematics in Montpelier Seminary, Montpelier, Vermont.

Let 100%=cost of the wine. Then 110% of $110\%=121\%$, the selling price of the mixture. Hence, $121\%-100\%=21\%$, the gain.

67. Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics in Drury College, Springfield, Missouri.

A agreed to work a year for \$300 and a suit of clothes. At the end of five months he left, receiving for his wages \$60 and the clothes. What was the suit worth?

Solution by P. S. BERG, Larimore, North Dakota.

Since he received \$300 and a suit of clothes for a year, for one month he received \$25 and $\frac{1}{12}$ suit of clothes, and for five months he received \$125 and $\frac{5}{12}$ suit of clothes. He received \$60 and the clothes, hence \$60+suit of clothes= \$125+$\frac{5}{12}$ suit of clothes, or $\frac{7}{12}$ suit=\$65. Whence once suit=\$111$\frac{3}{7}$.

Also solved by *E. W. MORRELL* and *JAMES F. LAWRENCE*.

68. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.

The population of a city is annually increasing $m=2\frac{1}{2}\%$. If the population now is $P=68921$, what was it $n=3$ years ago? At this rate of increase, what will the population be $n=3$ years hence?

Solution by P. S. BERG, Larimore, North Dakota.

Let 100%=what the population was 3 years ago. Then the population at present is $(100\%+2\frac{1}{2}\%)^3$. Hence $(100\%+2\frac{1}{2}\%)^3=68921$. Whence 100%= 64000, the population 3 years ago. In 3 years hence the population will be $(100\%+2\frac{1}{2}\%)^3$ of 68921, or 74220.378765625.

69. Proposed by EDGAR M. JOHNSON, Professor of Mathematics, Emory College, Oxford, Georgia.

Every man in a certain group belongs to at least one of these classes: Methodists, Democrats, Farmers. In the group there are 10 Methodists, 12 Democrats. 13 Farmers; 3 men who are Methodists and Democrats, 4 who are Democrats and Farmers, 5 who are Methodists and Farmers. Finally, there are 2 men who are at the same time Methodists, Democrets and Farmers. Required the number of men in the group.

I. Solution by J. C. CORBIN, Pine Bluff, Arkansas.

Using obvious abbreviations, we can form the following table in which each small letter denotes a man:

Methodists.	Democrats.	Farmers.
a, b	a, b	a, b
c, d, e, f, g	h, i, j, k	h, i, j, k
l, m, n	l, m, n	r, s
	o, p, q	

Counting each letter once only, gives 19; 10 in the first column, 12 in the second column, and 13 in the third column.

II. Solution by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas-Texas, and FREDERICK R. HONEY, Ph. B., New Haven, Connecticut.

Methodists.	Democrats.	Farmers.	Total.
3	3	0	3
0	4	4	4
5	0	5	5
2	2	2	2
10	9	11	14
0	3	2	5
10	12	13	19

$\therefore$ 19 men in the group.

Also solved by *E. W. MORRELL*, *JAMES F. LAWRENCE* and *P. S. BERG*.